Environmental Protection Network

(202) 656-6229
environmentalprotectionnetwork.org
info@environmentalprotectionnetwork.org

EPN Comments on Draft Supplemental Science Assessment on Particulate Matter

Docket Numbers: EPA-HQ-OAR-2015-0072; EPA-HQ-ORD-2014-0859

November 29, 2021

On behalf of theEnvironmental Protection Network (EPN), we thank EPA Administrator Michael Regan, the Clean Air Scientific Advisory Committee (CASAC), and EPA staff for the opportunity to provide these written comments at this important stage of the current reconsideration of the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM). EPN is a volunteer organization of former EPA employees and others concerned about public health and the environment.

Having participated in the most recent PM review, EPN is grateful Administrator Regan decided to reconsider the problematic decision not to strengthen the PM standards and to supplement both the Integrated Science Assessment (ISA) as well as the Policy Assessment (PA) to add consideration of a significant body of relevant scientific research to the comprehensive reviews of literature in 2019 and 2020 documents. Our comments here focus on the draft Supplement of the ISA.

At the outset, we are well aware of the additional burden this supplemental review places on EPA staff to identify and assess the most relevant new material and place it into context with the 2019 ISA. We agree with a number of CASAC panel members that overall, the Supplement was well written and reflects careful synthesis of an enormous amount of information. We also appreciate CASAC's discussions and recommendations to clarify decisions EPA made on studies and issues most relevant to a timely reconsideration of the PM NAAQS and EPA recommendations on the PM standards. We particularly appreciate CASAC's delineation of certain revisions that are necessary and others as suggestions that are left to EPA's consideration. Further, EPA staff have a long history of careful consideration of CASAC and public comments, and we encourage CASAC to entrust them to consider comments and not request a second draft for CASAC review.

Our comments focus on the need to (1) consider relevant studies published since early 2018 that were not cited and discussed in the draft Supplement and (2) rethink the appropriate integration of specific controlled human studies showing responses at near-ambient $PM_{2.5}$ levels with panel studies that provide support for these findings under real-world exposure conditions.

1). *Consideration of omitted newer studies of potential relevance.* EPA states that the studies included in the draft Supplement to the ISA as well as those discussed in the draft PA "further inform the adequacy of the current PM NAAQS or address key scientific topics that have evolved since the 2020 PM NAAQS review was completed" (P1-2), and are the "recent studies deemed to be of greatest significance for impending regulatory decisions regarding the PM NAAQS in the context of the body of evidence and scientific conclusions presented in the 2019 PM ISA" (P1-4). EPA asks CASAC to comment on "whether there are any topics or studies … that should be added or receive additional discussion or any topics for which discussion should be shortened or removed" (Charge Questions 4.c. and 5.c.).

We believe that certain additional studies should be included in the Supplement to the ISA based on their clear relevance to assessing the adequacy of the current NAAQS and EPA's decisions on revised standards (see below). Some members of CASAC and other commenters have also identified studies for inclusion in

the Supplement. Beyond these, we are not aware of other studies or areas of scientific research that have not been included that would have a significant impact on or change the judgments or conclusions drawn from the science in the Supplement to the ISA or the PA.

An important part of CASAC's role is to provide its views on this issue. CASAC should state that, subject to inclusion of additional studies it may identify, CASAC is not aware of studies or areas of scientific research that have not been included that would have a significant impact on or change the judgments or conclusions drawn from the science in the Supplement to the ISA or the PA.

We suggest the following studies be considered in the review:

Vodonos A, Y Abu Awad, J Schwartz. 2018. The concentration-response between long-term $PM_{2.5}$ exposure and mortality; A meta-regression approach. *Environmental Research* 166:677-689. https://doi.org/10.1016/j.envres.2018.06.021
We systematically searched all published cohort studies examining the association between long-term exposure to $PM_{2.5}$ and mortality. We applied multivariate linear random effects meta-analysis with random effects for cohort, and study within cohort. Meta-regression techniques were used to test whether study population or analytic characteristics modify the $PM_{2.5}$ mortality association and to estimate the shape of the concentration-response curve.

Zigler CM, C Choira, F Dominici. 2018. Impact of National Ambient Air Quality Standards nonattainment designations on particulate pollution and health. *Epidemiology* 29(2):165-172. doi: 10.1097/EE9.0000000000000052. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5792368/
We employ causal inference methods and a spatial hierarchical regression model to characterize the extent to which a designation of "nonattainment" with the 1997 National Ambient Air Quality Standard for ambient fine particulate matter (PM2.5) in 2005 causally affected ambient PM2.5 and health outcomes among over 10 million Medicare beneficiaries in the Eastern US in 2009–2012.

Schwartz JD, Yitshak-Sade M, Zanobetti A, Di Q, Requia WJ, Dominici F, Mittleman MA. A self-controlled approach to survival analysis, with application to air pollution and mortality. *Environ Int*. 2021 12. 157:106861. PMID: 34507231
We used a self-controlled design for survival analysis. We stratified on each person in the Medicare cohort between 2000 and 2015 who died, and examined whether PM2.5, O3 and NO2 exposures predicted in which follow-up period the death occurred. We used conditional logistic regression stratified on person and controlled for nonlinear terms in calendar year and age. By design slowly varying covariates such as smoking history, BMI, diabetes and other pre-existing conditions, usual alcohol consumption, sex, race, socioeconomic status, and green space were controlled by matching each person to themselves. Results: There were 6,452,618 deaths in the study population in the study period.

Zhang S, Breitner S, Cascio WE, Devlin RB, Neas LM, Ward-Caviness C, Diaz-Sanchez D, Kraus WE, Hauser ER, Schwartz J, Peters A, Schneider A. Association between short-term exposure to ambient fine particulate matter and myocardial injury in the CATHGEN cohort. *Environ Pollut*. 2021, 275:116663. doi: 10.1016/j.envpol.2021.116663.
In this study, we investigated short-term PM2.5 effects on cardiac troponin T (cTnT), as well as N-terminal-pro brain natriuretic peptide (NT-pro BNP) and inflammatory biomarkers among cardiac catheterized participants. We analyzed 7444 plasma cTnT measurements in 2732 participants who presented to Duke University Hospital with myocardial infarction symptoms between 2001 and 2012, partly along with measurements of NT-pro BNP and inflammatory biomarkers. Daily PM2.5 concentrations were predicted by a neural network-based hybrid model and were assigned to participants' residential

addresses. We applied generalized estimating equations to assess associations of PM2.5 with biomarker levels and the risk of a positive cTnT test (cTnT > 0.1 ng/mL).
(See below).

2) We believe the Supplement should have a more integrated discussion of the implications of recent controlled human studies at near ambient levels, with the results of both new and earlier panel studies of real-world exposures for assessing risks of higher short-term exposures permitted by the current daily standards. A contextual reassessment of these studies would have implications for environmental justice and a reconsideration of the short-term $PM_{2.5}$ standard.

The 2019 ISA cites several studies focusing on the higher risk endured by people of color, lower socioeconomic status (SES), and pre-existing health conditions. Several more recent studies are noted in Section 3.3 of the Supplement reinforcing and extending this concern. Higher exposures in people of color and social disadvantage are clearly noted with new evidence showing the importance of point sources in such sectors (e.g., Tessum *et al.*, 2021). Point sources of primary particles are more likely to produce higher short-term levels among those living nearby, with these populations also burdened more often with socioeconomic and health disadvantages (e.g., Tessum *et al.*, 2021). Accordingly, we believe more attention should be paid to the potential effects of single and repeated short-term peaks (hours to daily) on these populations.

Reliance on large epidemiology studies for statistical strength, even with the newer "causal-inference" approaches, often do not focus on public health burdens imposed in local areas. The link lies in the empirical health data in controlled human studies as well as in panel studies, with coherent biological evidence from animal toxicology studies. We currently have two controlled human exposure studies that report 4-5 hour exposures to ambient levels of $PM_{2.5}$ (24 and 38 ug/m^3) produce cardiopulmonary responses (Wyatt *et al.*, 2020; Hemmingsen *et al.*, 2015).[1] The 2019 ISA included a number of relevant panel studies, but they are largely lumped in with the larger epidemiology data where the results are undervalued. In addition, the Supplement does not cite or discuss the important new U.S. panel study noted above (Zhang *et al*, 2021). The authors conclude that "[o]ur study suggests that acute $PM_{2.5}$ exposure may elevate indicators of myocardial tissue damage. This finding substantiates the association of air pollution exposure with adverse cardiovascular events." We cite several relevant earlier panel studies below.

Taken only as affirmation of plausible causality misses the impact these combined studies reveal on daily and hourly exposure via effects on inflammatory and cardiopulmonary variables in elderly and at-risk people at or below the daily NAAQS. Taken together with the controlled human exposure studies noted above, they show coherent cardiac and inflammatory markers, lending credence to the results of larger short-term epidemiology studies in the Supplement, which find more serious responses when restricted to levels below the 24-hour $PM_{2.5}$ standard. Several of these larger studies show mortality and morbidity via downstream cardiac and inflammatory events.

We believe it is important for the Supplement to summarize the overall coherence and confirmation of the controlled human, panel, and short-term epidemiology studies. This would not require a full discussion of the panel studies in a new section. It would be sufficient to provide some examples to provide more context

[1] At the public meeting, CASAC panel member Dr. Jennifer Peel indicated she may be providing an additional controlled human study finding $PM_{2.5}$ effects at ambient levels.

to the discussion of the controlled human studies that find responses at ambient levels, as well as carrying the linkages forward to an appropriate summary section.

In summary, the inadequacy of the daily NAAQS is revealed by contextual coherency of existing and new short-term panel studies along with acute controlled human exposure studies. This inadequacy is clear and necessitates reassessment of the daily $PM_{2.5}$ NAAQS. We will submit additional written comments on the draft PA that outlines why we believe that both annual $PM_{2.5}$ NAAQS and daily standards need to be significantly strengthened.

References for Comments on Integrating Controlled Human, Panel, and Short-term Epidemiology Studies:

Tessum, CW, Paolella, DA, Chambliss, SE, Apte, JS, Hill, JD, Marshall, JD. (2021). PM2.5 polluters 35 disproportionately and systemically affect people of color in the United States. *Science Advances* 7. 36 http://dx.doi.org/10.1126/sciadv.abf4491 37 T

Controlled Human Studies

Wyatt LH, Devlin RB, Rappold AG, Case MW, and Diaz-Sanchez D. Low levels of fine particulate matter increase vascular damage and reduce pulmonary function in young healthy adults. *Particle and Fibre Toxicology,* 2020, 17:50; https://doi.org/10.1186/s12989-020-00389-5

Hemmingsen JG, Rissler J, Lykkesfeldt J, Sallsten G, Kristiansen J, Møller P, and Loft. S. Controlled exposure to particulate matter from urban street air is associated with decreased vasodilation and heart rate variability in overweight and older adults. *Particle and Fibre Toxicology,* 2015, 12:6. DOI 10.1186/s12989-015-0081-9

Select Panel Studies

Zhang S, Breitner S, Cascio WE, Devlin RB, Neas LM, Ward-Caviness C, Diaz-Sanchez D, Kraus WE, Hauser ER, Schwartz J, Peters A, Schneider A. Association between short-term exposure to ambient fine particulate matter and myocardial injury in the CATHGEN cohort. *Environ Pollut.* 2021, 275:116663. doi: 10.1016/j.envpol.2021.116663.

Peters A, Dockery DW, Muller JE, and Mittleman MA. Increased Particulate Air Pollution and the Triggering of Myocardial Infarction. *Circulation*. 2001;103:2810–2815. https://doi.org/10.1161/01.CIR.103.23.2810

Schneider A, Neas L, Herbst MC, Case M, Williams JW, Cascio W, Hinderliter A, Holguin F, Buse JB, Dungan K, Styner M, Peters A., and Devlin RB. Endothelial Dysfunction: Associations with Exposure to Ambient Fine Particles in Diabetic Individuals *Environ Health Perspect* 116:1666–1674 (2008). doi:10.1289/ehp.11666 available via http://dx.doi.org/

Liao D, Shaffer ML, Rodriguez-Colon S, He F, Li X, Wolbrette DL, Yanosky J,and Cascio WE. Acute Adverse Effects of Fine Particulate Air Pollution on Ventricular Repolarization *Environ Health Perspect* 118:1010–1015 (2010). doi:10.1289/ehp.0901648

Sinharay R, Gong J, Barratt B, Ohman-Strickland P, Ernst S, Kelly FJ, Zhang JJ, Collins P, Cullinan P, Chung KF. Respiratory and cardiovascular responses to walking down a traffic-polluted road compared with walking in a traffic-free area in participants aged 60 years and older with chronic lung or heart disease and age-matched healthy controls: a randomised, crossover study. *Lancet*. 2018, 391(10118):339-349. doi: 10.1016/S0140-6736(17)32643-0.
Note: This study, which includes measurements of $PM_{2.5}$, ultra-fine particles, and Black Carbon, was not included in the 2019 ISA or the Supplement.

These comments were prepared by John Bachmann (former Associate Director for Science/Policy and New Programs, EPA Office of Air Quality Planning and Standards, with a lead role in all reviews of the PM NAAQS through 2006), Dan Costa (former National Program Director, Air, Climate, and Energy Research and Development, EPA Office of Research and Development), and John Hannon (former Assistant General Counsel, EPA Air and Radiation Law Office, supervising attorneys working on NAAQS standard setting).